ENGINEERING NEWS.

Tribune Building, New York City.

GEO. H. FROST, PROPRIETOR.

SATURDAY, ARPIL 16, 1881.

WE wish to call attention to the opportunity now given to buy certain numbers of the Weale's series of scientific books at a very low price. These books are always in demand, and we offer the present stock at less than second-hand prices. Only those in the present list will be sold at the offered discount. Any *present subscriber* sending us *one new name* with *four dollars* may order *one dollar's worth* of books from the list, and they will be sent post-paid to any address.

IN order to supply the constant demand for a temporary binding case for ENGINEERING NEWS we have laid in a stock of Russell's *Common Sense Binders*, which we advertise elsewhere. This binder is sold in large quantities by the principal newspaper and magazine publishers of the country, and, so far as we can learn, has given general satisfaction. The price is $1.50, postage paid.

ELSEWHERE in this issue we publish the paper read by Justice Cooley, of the Michigan Supreme Court, before the Michigan Association of Surveyors and Civil Engineers, on "The Judicial Functions of Surveyors." The paper is a valuable one on re-establishing monuments and boundaries, and a disquisition on meander lines, citing the duties devolving upon the surveyor according to law, and giving what should be his course in disputed cases. Of course the paper, being for the benefit of the profession in Michigan, gives the law and accepted practice in that State, yet as the questions are those of equity, the decisions will bear in other States under like conditions. County surveyors will find in it many points of great interest and usefulness.

WE have obtained additional particulars in regard to the International Congress of Electricians and the Electrical Exhibition which are to take place in Paris during the months of August and September next. The project has excited much interest in scientific circles in this city, and many exhibits have already been sent. In the absence of Congressional action, the State Department is doing all in its power to promote a creditable representation of the United States, both at the Congress and at the Exhibition. The commission now being organized is a voluntary one, and will be under the guidance of Mr. George Walker, the United States Consul General at Paris. It has been definitely announced by the Commissioner General of the Congress, M. George Berger, that the electric lighting of the Palace of the Champs Elysées and its annexes will take place each evening, and the lighting of the Exhibition will be by a combination of all systems, French and foreign. The order of classification in which the objects to be exhibited are to be catalogued is as follows:

1. Production of Electricity.
2. Transmission of Electricity.
3. Electrometry.
4. Applications of Electricity.
5. General Mechanism, including applications to electric purposes.
6. Bibliography and History.

Those who contemplate exhibiting should address the Assistant Secretary of State at Washington, D. C. As we stated in a previous note, the Exhibition will embrace all inventions and applications of electricity to science, art, manufacture, navigation, telegraphy and commerce.

HISTORY OF AMERICAN WATER-WORKS.

The success which is attending Mr. Croes' papers on the above subject is most gratifying to us. From all parts of the country we have received the most flattering comments on our enterprise, and the courteous and prompt responses to our inquiries for information have thus far been indicative of the most friendly co-operation. We are very much pleased, therefore, and we think, that as the plans of Mr. Croes are developed in the months to come, our readers will more and more fully appreciate the great labor that he has undertaken. In answer to inquiries we will say that statistics carefully tabulated will be forthcoming in due time; that the papers will be illustrated where it is considered desirable, and that chapters will be devoted to special subjects of importance to all interested in water-works construction. We hope our readers will continue to take a lively interest in these papers, to show them to their friends, to send us information, and in every possible way assist in preparing a standard work of information on the public water supply of American cities and towns. We have not as yet "sent circulars" to superintendents, and do not propose to until we have exhausted the voluntary contributions, but we intend to "run down" every one of them eventually until we get everything into print that is possible to obtain, so that we think our subscribers can depend on getting the record "brought down to date" by the time Mr. Croes sends in his last manuscript. But, the fact is, one of the most pleasing amenities of engineering journalism is the prompt and generous response which is usually accorded to the reasonable requests of the journals by the classes to whom they are addressed. We do not know how other journals fare with their constituents, but, catering to engineers has been with us always a genuine pleasure, and the more we see of them the better we like them. It is, therefore, with no unusual confidence that we occasionally pester them with requests for information to be distributed among the fraternity for the general benefit of all.

PERSONAL.

Chief Engineer Latimer recently read a paper before the Ohio Auxiliary Society for Preserving Our Weights and Measures, and also before the Civil Engineers' Society of Cleveland, proving that the Anglo-Saxons' measures were the measures used in constructing the great pyramid of Ghizeh.

A dispatch from Houston, Texas, says that the Texas Western Narrow-gauge Railroad has been sold under foreclosure to Colonel W. B. Botts for $100,000. A new company will be formed with H. H. Honore, of Chicago, as President, and Colonel Fred D. Grant will probably resign from the army to take charge of the road as Chief Engineer. The road will be extended from Patterson, its present terminus, to Presidio, on the Rio Grande.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.*

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 143.)

ST. LOUIS, CONTINUED.

The removal of the deposit from the old distributing reservoir above alluded to is thus fully described by Col. Flad under date of April 8, 1881.

The quantity of the sediment to be removed is 140,000 cubic yards.

Its depth varies from 7 to 31 ft.; the depth first named, however, prevails only on a 60-ft. strip where an attempt had been made to grade a 60-ft. street through the reservoir.

This work had to be abandoned on account of the great cost of handling the material. I think it would cost from 60c. to 75c. per cu. yd. to remove it by spade and cart. For 2 or 3 ft. immediately below the surface the sediment is loose and porous, but its density increases with the depth, and near the bottom it is very hard, and might be taken for soapstone.

In washing we use two 1¼-in. streams, supplied by 4-in. hose, which latter are connected by 4-in. gas-pipe with a 12-in. main.

We also use some smaller streams and hose to furnish additional water and keep the trench clear etc.

The pressure in the 12-in. main generally is about 30 lbs., and the quantity of water used is from a million to 1,200,000 galls. per day.

The washing is carried on by three gangs day and night, each gang working eight hours and consisting of 3 men each.

The water and sediment are carried a distance of 6,000 ft. to some low grounds near the river, where the mud is allowed to settle and fill up the lots.

The owners of the property pay 3 cents per cu. yd. for the material delivered there.

The work of washing was begun about the 15th of June, 1880, and continued for 100 days. It had been intended to carry it on during the winter, but the men could not stand it, although provided with the best of clothing.

Since the stream under 30 lbs. pressure was not strong enough to allow the men to stand off some distance from the bank, to do effective work they have to get within 15 or 20 ft., and then the spray flies into their faces and is particularly hard for their eyes. Since Nov. 1, no work has therefore been done.

Work was resumed a few days ago, but high water in the river now interferes with the settling on the lots in its vicinity.

In the 100 days' work about 30,000 cu. yds. were removed. The plant, including flume 6,000 ft long, pipes, valves, etc., labor of laying pipes, trenching, breaking through reservoir walls, cleaning surface of stones, etc., cost $4,400.

Tools, hose, nozzles, etc., $1,200.

Sundries (fuel, oil, etc.), $300.

Wages of hosemen, employed in washing, watchmen, etc., $2,200.

Total to date, $8,100.

The first three items will not, of course, require much if any additional expenditure.

The washing costs about $22.00 per day. The average amount removed per day is about 300 cu. yds. since we have gathered some experience in the business. It costs, therefore, for labor about 7c. per cu. yd. The total expenditure for plant, tools, etc., will probably reach $7,000 before we get through, and this amount, distributed on 140,000 cu. yds., will make the cost per cu. yd. 5c. additional.

Total cost per cu. yd. removed will therefore be about 12c., and as we get 3c. per cu. yd. the actual cost of the removal will be about 9c. per cu. yd.

The city directrix of St. Louis is 33.83 ft. above the low water of December, 1863, and 7.58 ft. below the high water of June, 1844. These figures were accidentally omitted on page 143 *ante*.

VII. BALTIMORE.

Baltimore, in Maryland, in lat. 39° 17′ W. and long. 76° 37′ 30″ W., at the head of navigation and tide water on the Patapsco River, 14 miles from Chesapeake Bay, and 200 miles from the ocean, embraces about 16 square miles. It is of irregular topography and divided by a stream called Jones' Falls, the ground east of the stream being from 13 to 262 ft., and on the west from 4 to 233 ft. above tide level. There are 762 acres at elevations of 171 to 233 ft.

Founded in 1730, the population in 1804 was

*Copyright, 1881.

30,000, and an association was formed for the purpose of "introducing a copious supply of wholesome water into the city of Baltimore," which purchased the water privileges of Jones' Falls, immediately above and below the present Eager street bridge, and constructed works from the plans of Mr. John Davis, of Philadelphia. A contract was made in June, 1805, for a supply of cast-iron water pipes from 2½ to 6 in. diameter.

In February, 1806, the Common Council authorized the company to lay pipes in the streets. In May, 1807, pumps, located at the intersection of Centre and Calvert streets, began supplying the city by elevating the water into reservoirs of various heights above tide water.

In 1808 the Legislature granted the company a suitable charter. In 1811 the income amounted to $9,000. In 1833 the company enlarged their water privilege by purchasing Salisbury Mill, and constructed a new reservoir and pump house. The number of takers at this time was 2,164 and the yearly income $21,300. In 1835 there were about 18 miles of pipe laid, one-fourth of old pattern cast-iron, one-fourth of wood, and the remainder new pattern cast-iron. Some of the old pipes, dug up in 1864, were found to be 3 in. in diameter, in sections of 5 ft., very heavy with conical joints.

They were in perfect condition, the sand outside uniting with the metal by oxidation and preventing further corrosion; within they were smooth, with a slight coating of earthy matter.

From 1835 to 1852, the demand increasing rapidly, the company purchased additional privileges on Jones' Falls, erected new pumps, built new reservoirs, and extended the distribution system. In 1852 the water rents were $80,000.

In 1854 the city purchased the works, privileges, and real estate of the company for $1,350,000.

The works at this time consisted of two small pools in Jones' Falls, from which the supply was conducted in iron mains to a receiving reservoir on the bank of the Falls below Charles street bridge, from which water was distributed to the section below 60 ft. above mean tide.

The district above this, not exceeding 136 ft. above mean tide, was supplied from a reservoir at Charles and Chase streets, into which the water was pumped.

Up to the time of the transfer to the city there had been laid about 69 miles of pipe.

The combined capacity of the reservoirs and pools on Jones' Falls were 35,000,000 galls. and the water was frequently quite turbid.

The works constructed in 1857 to 1862, under Charles P. Manning, as Chief Engineer, after the plans and under the general direction of James Slade, as Consulting Engineer, procured the water from a storage reservoir on Jones' Falls, near the Relay House, at first called Swann Lake, but now Lake Roland. A dam of rubble masonry faced with cut stone, with an overfall 120 ft. long at 225 ft. above tide, flanked by wing walls 6 ft. higher, with vertical back and curved face, founded on rock and backed with earth, was built across a narrow gorge, creating a lake of 116 acres water surface.

The dam is 40 ft. high and all of the surface flooded was excavated to a depth of not less than 10 ft. below the overfall.

The water of the stream is very much charged with sediment in freshets, and the lake became much filled with deposit, a large amount of which was removed in 1872 and again by dredging in 1876-7.

From Lake Roland the water is brought by an elliptical brick conduit, the bottom being a semi-circle of 5 ft. diameter, the top a semi-ellipse of 3.83 height, giving an area of 24.75 sq. ft. for 3.62 miles. On embankments the conduit rests on a wall of rubble masonry. It has proved durable, although used under an average head of 9¼ ft. It terminates at Hampden Reservoir, which is a semi-circle of 1,000 ft. diameter with a water surface of 8 acres, at 217 ft. above tide, and is in excavation and embankment, the inner slopes covered with 3 ft. of puddle, on which is 2 ft. of gravel, and over that an 18-in. stone pavement.

From this reservoir 3 lines of 30-in. cast-iron pipe are laid for 7,100 ft., passing under the bed of Jones' Falls, in a trench cut from 3 to 5 ft. in the rock, to Mt. Royal Reservoir, which is a circle of 550 ft. diameter and has a water surface of 5 acres at 150 ft. above tide. The screen well is in the centre of the reservoir, and one of the mains from Hampden Reservoir is led to it and to its roof, where it may be discharged as a fountain under 60 ft. head.

This reservoir supplies the portion of the city below 112 ft. elevation. The Hampden Reservoir supplies the districts between 112 and 188 ft. above tide, and the high-service reservoir, hereafter mentioned, the district between 188 and 330 ft. above tide.

There was found to be too little storage capacity, and between the Hampden and Mt. Royal reservoirs a reservoir first called Lake Chapman, but after 1867 Druid Lake, was begun in 1864, with the view of having a large reservoir of clear water to be used when the source of supply, Swann Lake, was muddy. Across a natural valley in Druid Hill Park, a dam was built 119 ft. high in the middle, a puddle wall 36 ft. wide at the bottom, is started from the rock 12 ft. below the natural surface, over a core wall of rubble masonry in cement, 5 ft. high and 2 to 4 ft. wide, built on the rock.

Adjoining the puddle wall the embankment was built up in layers, carted on and rolled and rammed for about 25 feet in height; about half way from the centre to the foot of the slopes trestles were built to the height of the centre bank, from which earth was dumped from cars.

The spaces between these banks were flooded and then filled in gradually by dumping earth into the water.

The same process was repeated in the next and succeeding heights of about 25 feet.

The same mode of making bank was used in filling a part of the reservoir bottom, about 300 by 900 ft., to a depth of from 3 to 25 ft., making the greatest depth of water 63 ft. in the lake.

Seven lines of cast-iron pipe were laid under the embankment; through the puddle wall they were carried on masonry piers; under the rest of the bank they were merely inclosed in the earth. They all broke within two years. Where there was less than 44 ft. of bank over them they were removed, and the others were capped and allowed to remain.

Five lines of 30-in. pipe were then laid through a cut in rock. On the rock is 0.75 ft. of concrete, then 0.75 ft. rubble masonry in cement; on this the pipes are laid, and built around with rubble masonry, the whole wall being 25 ft. wide at the bottom, 23 ft. at top, and 5.5 ft. high, with six collars of masonry projecting all around into the rock and earth cuts. There is also a wall on each side of the top of the masonry, 1 by 1.5 ft. from collar to collar. The sides and top are plastered, making smooth surfaces. Clay puddle covers the whole for five feet.

Three of the pipes are used for distributing water to the city, and draw from a depth of 39 ft.

One connects with the low-service main from Hampden Reservoir, and discharges 900 ft. up the lake; this pipe can also be made a drain pipe.

The fifth connects with the high-service main from Hampden Reservoir, and discharges 2,300 ft. up the lake; this can also be used as a siphon to draw out the lower 24 ft. in the lake.

The embankments are faced with rip-rap of large stones, arranged with some degree of care, from two feet above to ten feet below high-water level, and covered for the upper six feet with clean gravel from 1 to 3 in. diameter.

The capacity is 493 million gallons, and the water surface 53 acres. The extreme depth at the dam is 65 ft., and at the upper end 20 ft.

Water was introduced in January, 1871, and in February it came into constant use. An additional inlet pipe was laid in 1872.

A high service reservoir in Druid Hill Park, circular, 501 ft. in diameter and 20 ft. deep, was built in 1871-2. It is 350 ft. above tide, and is supplied by two Worthington pumps, placed at Druid Lake, 600 ft. distant.

It is in earth-work puddled 4 ft. thick on inside of slopes, and that covered with 1 ft. of gravel. From the force-main a branch is led into Druid Lake, and turned up, making a fountain which may be supplied from the high-service reservoir, or directly by the pumping engines.

The engines were first worked June 8, 1874.

The north embankment leaked at first. The reservoir was filled and the pumps stopped until the water fell some 12 ft. The alternate raising and lowering of the water had the effect of lessening greatly the percolation through the banks. It may be stated here that the high service reservoir in Boston leaked when new, until it was suddenly emptied on one occasion by the bursting of a pipe, and on filling it again it was found that the banks had become tight.

It became evident in 1870 that additional water was needed and examinations were made resulting in the adoption in 1872 of a plan submitted by R. K. Martin, and approved by C. P. Manning, the consulting engineer.

It is substantially the same one recommended by T. E. Sickels, in 1854.

Pending its construction a temporary supply from the Gunpowder River was obtained by pumping from great Gunpowder Falls into the head waters of Lake Roland, over an intervening ridge 205 ft. high.

Two Worthington pumps, of 5,000,000 gallons capacity each, pumping through 36-in. pipe for 3.5 miles, and discharging into a basin on Roland Run, two miles from the Lake, began pumping in July, 1874, and have run every summer since whenever there was a deficiency in the yield of Lake Roland.

The permanent additional supply is obtained from the Gunpowder River. The plan contemplates keeping the supply independent from that from Lake Roland, and supplying the lower levees of the city.

It was judged that seven-eighths of the population present or prospective would best be served by a reservoir 160 ft. above tide, and for a large portion of the city an elevation of 110 ft. will suffice.

The dam on the Gunpowder River, of stone masonry, founded on rock 13 ft. below water surface, and put in in 3 sections by the use of coffer dams, is 65 ft. wide at the bottom, 34 ft. high at the overfall, and 8 ft. higher on the wings; the overfall is 300 ft. long and its elevation is 170 ft. above tide level.

The reservoir formed by this dam is called Loch Raven, and is five miles long, with depth of water of 20 ft. at the dam. The borders of the stream have been excavated to the original stream-level, and the material placed in embankments outside the flow line. A circular conduit, 12 ft. in diameter, with fall of one foot per mile, and entirely in tunnel for 36,500 ft., conveys the water from Loch Raven to Montebello Reservoir, which is of irregular shape, 80 acres water surface and 163 ft. above tide, and is formed by two embankments in a ravine. The natural stream which flowed in the ravine is carried around the reservoir by a tunnel of 8 ft. diameter. From Lake Montebello a conduit, partly in tunnel and partly in open cut

conveys the water 5,891 ft. to Lake Clifton, which is elliptical, 1,700 by 1,200 ft., of 30.25 acres area, and 31 ft. deep, with its surface 163 ft. above tide. Provision is made for six 40-in. mains for distribution from this reservoir. Two of these mains will first be put in use.

The great tunnel from Loch Raven to Lake Montebello was begun in December, 1875, and completed in November, 1880. It is straight for seven miles, is from 65 to 300 ft. below the surface, and for six miles is through hard blue gneiss rock, and for one mile through limestone, in which large quantities of water, many fissures, and several pockets of semifluid material, were encountered. Fifteen shafts were sunk and the headings worked at 32 points; 11,691 ft. of the tunnel were arched. All drilling was done by hand, and blasting by giant powder or dynamite.

The tunnel cost for excavation $1,382,598.92, and for arching, cleaning and filling the shafts, $397,011.32.

The cost of the new permanent supply works to Dec. 31, 1880, had been $4,704,260.83.

All distributing pipe are of cast-iron. Changes in the distribution system have been made within the last five years, by which the head and circulation have been much improved. The amount of small pipe is very great, and the use of 2-in., 3-in. and 4-in. pipe is kept up. Of 1,467,091 ft. of pipe now in use, 981,954 ft. are of less than 6-in. diameter.

There are about 49,000 water takers; 524 meters are in use.

The population and pipeage every tenth year have been as follows:

Year.	Population.	Miles of pipe.
1830	80,620	....
1840	102,313	....
1850	169,054	45
1860	212,418	127
1870	267,354	206.2
1880	332,190	277

The consumption is not given in the reports, and does not seem to be known.

The Water Department is in charge of the Mayor and five Commissioners. James S. Suter was "Water Engineer" from 1857 to 1867, and James Curran has held the position since that time.

The works of additional supply have been in charge of R. K. Martin, C. E.

The expenses and revenue of the works for the eleven years ending Dec. 31, 1880, were as follows:

Expenses—Maintenance and extension of old works	$2,409,929.94
New works from Gunpowder River	4,704,260.83
Interest on water bonds	3,609,439.23
Total expenses	$10,723,630.00
Revenue	5,528,507.00
Outstanding bonds, December, 1880	9,000,000.00

VIII.—CINCINNATI.

Cincinnati, on the north bank of the Ohio River, in lat. 39° 6′ 30″ N. and long. 84° 24′ W., embraces about 24 sq. miles. A plain 60 to 100 ft. above the low-water river level extends along the river and back for some distance, when the ground rises rapidly to an elevation of 400 ft., and a second plateau affords fine building sites.

Founded in 1789 and incorporated as a city in 1819, its population in 1820 was 9,642, when Samuel W. Davis constructed works for the supply of water, consisting of a pump on the river bank, driven by horse power and lifting the water into a tank, whence another horse-power pump lifted it into a wooden reservoir, whence it was distributed through wooden pipes.

A steam engine with cylinder 12-in. diameter and 60-in. stroke, with a wooden beam, driving from one end two pumps, lifting water from the river to a tank on the engine-house floor, and thence forcing it to the reservoir by two pumps at the other end of the beam, all the pumps having 6-in. bore and 48-in. stroke, was substituted for horse power for pumping in 1824. This engine was remodeled in 1828 and abandoned in 1844.

On Jan. 27, 1826, Mr. Davis obtained a charter for the Cincinnati Water Company, with a capital of $75,000. In 1828 an 8-in. iron main was laid from the reservoir. In December, 1831, a fire destroyed the pumps, and the city was without water for three weeks.

A second steam-pumping engine was erected in 1832. It was an upright direct-acting engine, with fly wheel. The cylinder had 25-in. diameter and 96-in. stroke. The double-acting plunger pump beneath it, had 17-in. bore. The force main was of 20-in. diameter. This engine was used until 1864.

After several unsuccessful efforts to sell the works to the city, the sale was accomplished on June 15, 1839, and the water-works put in charge of a Board of Directors from the Common Council.

In 1846 another high-pressure engine, designed by Geo. Shield, was built, with horizontal steam cylinders 23-in. diameter and 120-in. stroke, working a fly wheel, to the crank-shaft of which was connected a vertical double-acting plunger pump of 14-in. bore and 120-in. stroke.

This engine has been in constant use ever since, pumping into reservoirs, with 165-ft., and since 1875 with 224-ft. lift, and is stated to be the most economical engine now in use in the water-works of Cincinnati. Steam is cut off at $\frac{5}{6}$ stroke. In 1847 the pump was temporarily stopped by high water in the river, which rose over the steam cylinders. In 1851 the engine-house floor was raised to about 2 ft. above the high water of 1847.

In 1851 a condensing engine, designed by T. R. Scowden, was built, with upright cylinder of 45-in. diameter and 96-in. stroke. The double-acting plunger pump is below the cylinder, and of 18-in. bore. A fly wheel is driven by a connecting rod from the piston rod.

In 1854 a duplicate of this engine was built. The pump cylinder of this was bored to 18¼ in. in 1879. These two engines are now used exclusively for the low service, pumping against 165-ft. head.

In 1865 a condensing engine designed by Geo. Shield was built. The steam cylinder is of 100-in. diameter and 144-in. stroke, vertical, and beneath it is a double-acting plunger pump of 46⅛ in. bore. Before 1874 this engine could not be run faster than 5 double strokes per minute, and the ram was so great that the force-main burst five times. Since 1874, owing to a change in the pump valves, it has been possible to run at 9 strokes per minute, and in 1879 the addition of 75 ft. to the working head improved its performance.

The force-main from this engine is 50-in. diameter, of wrought-iron, half-inch thick.

Two duplex, non-condensing engines, designed by T. R. Scowden, were erected in 1872–74. The steam cylinders are 28-in. diameter and 96-in. stroke, working pumps with buckets of 23½-in., and plungers of 16⅛-in. diameter.

High-service engines were constructed in 1869, from designs of A. G. Moore, taking the water from the main at the level of the low-service reservoir, and lifting it 290 ft. The first engine is a duplex non-condensing engine, with steam cylinder of 18-in. diameter, and 60-in. stroke, and pumps of 9-in. bore, enlarged in 1874 to 11-in., and in 1879 to 13⅛-in.

A compound engine, designed by A. Warden, was added to these works in 1879. It has a high-pressure cylinder of 14-in., a low-pressure cylinder of 22½-in., pumps of 10-in. diameter, all of 30-in. stroke.

The first reservoir built by the city was constructed in 1851, on Third st., 750 ft. from the engine house, and 165 ft. above it. It is rectangular, with dressed stone walls, entirely above the surface of the ground. It is in two divisions and its capacity is five million gallons.

In 1869 an iron tank 38 ft. high and 60 ft. in diameter was erected for the Mt. Auburn high service, and a similar one in 1870. The plates are 50 by 144 in. and from $\frac{11}{16}$ to $\frac{7}{16}$ in. thick. The vertical joints are double riveted. The bottom plates are ¼ in. thick.

[TO BE CONTINUED.]

We are pleased to acknowledge the receipt of the Eleventh Annual Report of the Water-works of Dayton, Ohio, from Jos. E. Waltz, Civil Engineer.

CORRESPONDENCE.

GRAPHIC METHOD OF PUTTING IN R. R. CROSSINGS, ETC.

BALTIMORE, MD., April 9, 1881.

EDITOR ENGINEERING NEWS:

Can you inform me through the columns of your valuable paper, of which I am a constant reader, where I can find graphic methods, diagrams, for putting in crossings from parallel tracks, both straight and curved, so it can be done with lines and a tape measure? Very truly yours,

H. W. B.

COMPRESSIVE STRENGTH OF CYPRESS.

VICKSBURG, Miss., April 7, 1881.

EDITOR ENGINEERING NEWS:

Will you allow me through your valuable columns to solicit a little information, which I have so far been unable to obtain through the medium of text-book or tables. What is the tensile and compressive strength of cypress? Also, what amount of straining force can cypress timber stand? Where can I purchase a chain similar to the one described by S. S. Haight, in ENGINEERING NEWS, Feb. 12, 1881?

I, as one of the "profession of peg setters" sincerely thank you for your able endeavors to disseminate truth and advance and elevate our profession.

Respectfully, YOUNG ENGINEER.

AMERICAN ENGINEERS IN MEXICO.

The following letter from a subscriber in Mexico we publish for information. The books mentioned we cannot find in New York, and we will be obliged if any reader of ENGINEERING NEWS can supply the needed information. [ED. ENGINEERING NEWS.]

GOATZACOALCOS, MEXICO, March 11, 1881.

EDITOR ENGINEERING NEWS:

I wish a copy of Bailey's instructions to the geodetic surveyors of Australia, which are mentioned in Frome's Geodesy, or a complete work on the use of the portable transit instrument in obtaining latitude and longitude. I see that the plain transit may be used for latitude, if adjusted to the prime vertical; but find no method given for such adjustment. Do you know whether the instructions to the British Columbia Boundary Surveyors are published, or the methods used by them for astronomical location? I wish to establish here an observatory for time, etc., and need the above information. Will you send me some book or papers covering this ground? I have a very good chronometer, which I shall regulate for standard time of road, and perhaps for the shipping. I am at present so busy on construction that I can spare no time for the purpose, but shall put up my instruments as soon as my section of R. R. is completed, say in 3 or 4 months. I would like to purchase a good second hand portable astronomical transit, if you could recommend one; but as you probably cannot, I shall send to Fauth & Co., of Washington.

Very Respectfully, ARTHUR HAVILAND,
Assistant Engineer, T. & O. R. R.,
Jaltipau P. O., Mexico.

HOWE TRUSS SPLICE.

PORTLAND, Me., April 12, 1881.

EDITOR ENGINEERING NEWS:

Mr. F. C. Doran's splice turns out exactly as I expected. He admits now that he "never designed or built a bridge with the splices in the lower chords of the exact proportions" shown in his plan, in your paper of Jan. 1. He takes back the statement that his splice had borne the est of experiment and practical work, and says

that the statement should have read: "The *principles* illustrated in the plan have borne the test of experiment and practical work." He also says that he did not offer the splice he gave as one to be followed out in practical detail, but that if he were designing such a splice for actual service he would probably make the hooks and blocks longer, on account of imperfections of workmanship, and consequent unequal distribution of strains. Precisely so. That is exactly what he would have to do. In reply to my suggestion that the short packing blocks would twist out of shape, Mr. Doran remarks that as the same principles apply to the blocks as to the hooks, a proper application of those principles can never result in realizing my fears that the blocks would twist. If he means by this that if he was making such a splice for actual service he would make the blocks longer, I say again, precisely so. That is what he would have to do, as it is quite common for packing blocks 4 inches wide and 18 inches long to twist so as to make the bearing very oblique.

Mr. Doran thinks that my 30 years' practice ought to have produced a better clamp hook than one a foot long which shears off. He is right. I never made a hook less than 18 inches in oak, and 24 inches in pine; and I never made one that sheared off. I only said that it was a common thing to find hooks a foot long that had sheared off, and from that fact I doubted the ability of his 2½ inch hooks to stand the strain. Can Mr. Doran tell us, as a matter of fact in actual bridge carpentry, that four 2½ inch hooks have ever been proved stronger than one hook a foot long? I don't mean can he prove it by what he calls the analysis of science, but does he know it to be a fact in practical bridge carpentry? for if I understand your first correspondent, he wants to know as a matter of practical bridge building, and not as a matter of theoretical speculation, what is the best splice.

E. S. Shaw.

CRIBWORK IN CANADA.*

The use of cribs for piers, dams, etc., is common in all parts of America, as they are well adapted to meet the requirements of many descriptions of canal and river work. The cribs are merely open or close boxes, made of timbers strongly framed together; they may be of any size, are easily built, cost little, and are most durable. Indeed, the part of the crib below low water may said to be almost everlasting, while the life of the upper part varies from ten to twenty-five years, and depends upon the kind of timber and the conditions to which it is subject. The timbers employed in their construction are generally brought to the site in rafts; they are of all lengths and have scantlings of from 10 inches to 15 inches square; they should be straight, and free from shakes, sap-wood, unsound knots and other defects. White pine, as a rule, is used above low-water line, as being the most durable; but below this level any good timber, such as pine, oak, ash, tamarac, elm, cedar, hemlock, poplar, maple, may be selected, and it is only necessary to discard such worthless specimens as basswood. With respect to the scantlings, it is the custom to specify, as a matter of economy, that payment will be only made for sizes up to 15 inches square. The biggest baulks are chosen for the bottom of the crib, and the others are made to work in, all the timbers being axed or sawn to the proper dimensions.

The cribs in the Lachine canal (plate 13, Figs. 1 and 2) are at least 30 feet in length, and 15 or 30 feet wide, according to their position in the pier. The side and end timbers are 12 inches square, and are laid close on both faces of the crib. They are joined to each other at the angles by double-beveled dovetails (Fig. 3). The cribs are strengthened by transverse and longitudinal ties, each of which extends over the full width or length of the crib, and their ends are dovetailed into the timbers above and below them. They are 14-inch timbers, flattened on two sides to a thickness of 10 inches, and the cross-ties are laid 10 feet apart. As regards the longitudinal ties, it is usual to build a simple vertical centre tier in cribs up to 20 feet in width, two vertical tiers equally distributed in cribs from 20 to 30 feet wide, and so on. At times, however, the longitudinals are spaced 3, 4, or 5, etc., feet apart, the distances between them depending on the nature of the stresses to which the cribs may be subjected.

The framing is further secured by ⅝-inch rag-bolts, 12 inches long, through the corner dovetails in each course, and by ⅞-inch rag-bolts, 24 inches long, through the heads of each tie. The longitudinals are also checked into the cross-ties, and fastened to them by 2-inch white oak trenails, 16 inches long. Three ranges of 4-inch plank binders, 10 inches wide, are fixed to the inside of each face of a crib by means of ⅝-inch spikes, 10 inches long. Thus there are six ranges in all, one being placed at each angle, and one at the center of each face.

The ballast floor consists of timbers flattened on two sides to a thickness of 10 inches; they are spaced from 18 inches to 24 inches apart, and rest on the first or second course of the side timbers, to which each piece is united by a ¾-inch rag-bolt, 18 inches long. The floor is often supported by one or more longitudinals according to the width of the crib; these are dovetailed into and secured to the end timbers. The side timbers of the floor are usually square.

The crib is generally built in shallow water, then towed to its proposed site, and moored in position ready for sinking. It must rest uniformly and evenly on its bed, and for this reason careful soundings have to be taken very near one another; it is necessary to remove all obstructions and inequalities, or else give to the bottom of the crib such a contour as will enable it to fit the bed. A strong platform is laid on the crib, and heavy stones are heaped upon it, until it sinks in place, when it is immediately filled with closely-packed, moderately sized and approved stones. Provision should be made for any settling that may take place, and wedge-like portions are to be cut away or added, as required, so that finally all the lines may be true and regular.

In a type of crib which has been successfully introduced by Mr. John Kennedy, M. Inst. C.E., the Harbor Engineer of Montreal, a somewhat different construction has been adopted. These cribs were originally made about 40 feet long, but it is now usual to build them in lengths varying from 100 to 120 feet, as the timbers work in better, and the cost is thus reduced. Taking the case of a crib for a depth of 24 feet of water, it is 23 feet wide at the bottom and 15 feet 6 inches wide at the top, which is 9 feet 6 inches above low-water line; its total height is therefore 33 feet 6 inches. The face has a batter of about 1 in 5, and is close-jointed; the back is plumb to low-water line, and is drawn in above this line, to the required width. The back and ends are open work, the spaces between the timbers depending upon the different courses of ties. Up to low-water line, or perhaps within one course of such line, the timber worked into the crib is chiefly hemlock, which is the best of the cheaper kinds; but any good and sound wood may be used, excepting bass. The remaining height of 9 feet 6 inches is built of approved white pine, and is faced with pine or tamarac planking, 3 or 4 inches thick. The ballast floor is carried by ten flattened cross-ties, spaced from 6 to 8 feet apart, dovetailed into the walls, and checked into the longitudinals beneath. Five rows of longitudinals, in addition to those under the walls, extend along the bottom of the crib, so as to form a good bearing surface upon the dredged bed, and prevent the crib from being pushed forward by the pressure of the earth-filling in the rear. The floor is generally made of inferior timber and cuttings laid with open joints. The finer ingredients of the ballasting can thus run through, fill up the space below, and form as solid a union as is practicable between the natural soil and the crib filling. After the crib has been sunk in place by suitably loading it on the top, ordinary river dredgings of any kind, save running sand, very soft clay, etc., are dumped into it; preference, however, is given to stones, gravel, boulder clay, shale, etc., especially toward the bottom. When the site of the crib is uneven or bad, or if there is reason to fear that the ballast floor might partially settle and leave an opening in the front, large stones are first filled in, and then smaller sizes, so as to close up any breaks that might occur, and secure the finer material above.

The cribs are separate up to within about 12 inches of low-water line; but above this the timber work is built in continuous courses, and is finally closed in with hemlock or tamarac planks 4 inches thick. Tamarac is the stronger and more durable wood; but either hemlock or pine is cheaper, and is amply sufficient in every respect for both covering and facing. Formerly it was the practice to fix along the cribs, both front and back, heavy oak coping pieces; these, however, were at least four times as expensive as smaller tamarac copings, while the latter have enough strength and durability to meet all requirements. Iron vertical and waling straps were also used to bind together the front coping and facing; but they caused the rapid decay of the timber adjoining them, and have consequently been discarded.

The cost of one of these cribs in place in a depth of 24 feet of water, varies from $22 to $24 per lineal foot, exclusive of the cost of filling. The corresponding cost of a crib 19 feet 6 inches high, *i.e.*, for a 10-foot depth of water, varies from $19 to $20 per lineal foot.

The inside and the rear of the cribs are filled with river dredgings, brought to the required site on flat-deck scows. The dredgings are there handled by a simple form of "clam-shells," worked by floating steam derricks. The cost of handling chiefly depends upon the nature of the dredgings, and ranges from 5 to 20 cents per cubic yard.

Many cribs are constructed without ballast floors, in which case the ties, both transverse and longitudinal, are built in close-jointed vertical tiers, so as to form a number of rectangular boxes. These boxes are filled with suitable stones, which are pressed into the sides, and hold the crib in position. A cribwork pier is easily ripped up and removed by an ordinary spoon dredge. The life of the portion of a crib below water, as already stated, is practically everlasting; but the life of the part above water varies exceedingly. Recently it was found necessary to remove for repairs a crib which had been in place more than twenty-three years. When the crib was uncovered the whole of the timbers up to low-water level were discovered to be perfectly good and sound, while above this level there were only four courses which required to be replaced. This rather unusual longevity may be thus accounted for: During the winter the wharves are totally submerged; in the spring the ice disappears, and the water falls a little below the coping; then comes down the North water and almost submerges the wharves again; after this the river gradually lowers, and reaches its lowest level about October; it rises again in December. The upper portion of a crib is therefore dry during from two to five months of the year only.

In another example of cribwork, executed under rather exceptional conditions, the cribs were built in the construction of a dam at the Carillon Rapids, on the Ottawa River. They rest on a flat ledge of rock extending across the rapids, and are secured to it by chisel-pointed wrought-iron bolts, 1½ inches in diameter. Holes 1½ inches in diameter, and from 12 to 18 inches in depth, were drilled into the rock and filled with pine plugs; into these were driven the bolts, numbering four on each side and three at the upper end. Each crib is 46 feet wide, and on an average 20 feet in length. The side and end timbers are 12 inches square and 8 inches apart; the distance between the ties is 8 feet, except in the case of the ties immediately above the bottom course, which are laid about 4 feet 2 inches from center to center, so as to form a ballast floor. All the timbers are jointed and dovetailed, as already described, and the framing is further strengthened by ¾-inch rag-bolts through the corners and heads of the ties; the corner bolts are 16 inches and the head bolts 26 inches long. The part of the structure above water is close sheeted with tamarac planks 4 inches thick, which are fastened to the crib timbers by 8-inch pressed spikes; the lower ends of the planks are cut to fit the rock contour. The details of the cost of this cribwork, when completed, were:

Timbers 12 inches square in section	$0.17	per lineal foot.
4-inch tamarac planking	0.10	" superficial ft.
Stone filling	0.55	" cubic yard.
Gravel above crib	0.50	" " "
Wrought-iron in rag, fox, or screw-bolts	0.14	" lb.
Drilling holes from 1½ inch to 2¼ inches in diameter	1.50	" lineal foot.

Plate 13 has been prepared from one of the twelve drawings which accompanied the original communication.

The Chesapeake & Ohio road will complete its extension from Richmond to the sea by July 1, and the connection westward by way of the Lexington & Big Sandy line to Lexington, Ky., will be finished by October 1. This entire line of 650 miles will be steel-railed. The rails are now on the ground.

* Part of a communication descriptive of "The St. Lawrence Navigation and Canal Construction," to be dealt with separately.—Sec. Inst. C.E.

Paper read before the Institution of Civil Engineers, by Henry Taylor Bovey, M.A., Assoc. Mem. Inst. C.E. Session 1880-81.

CRIBWORK IN CANADA

Fig. 1.

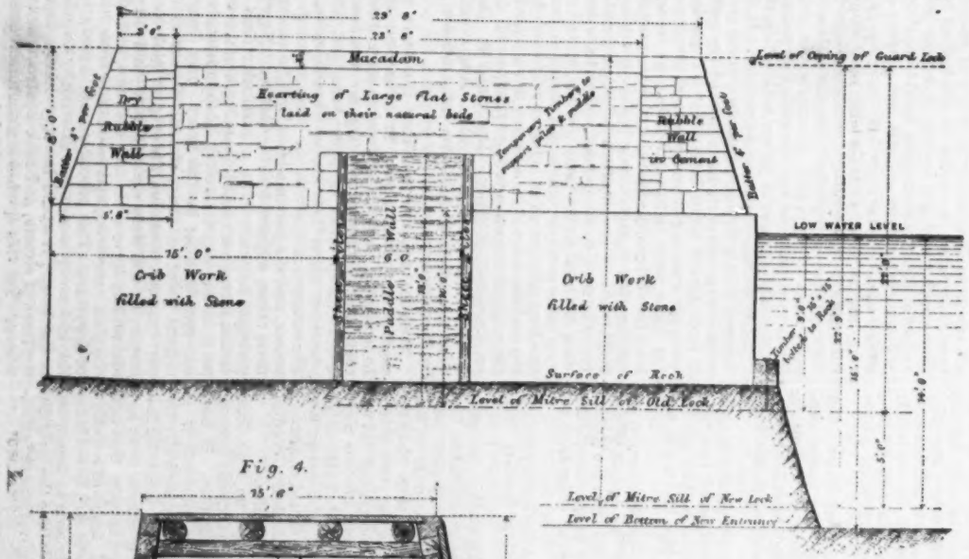
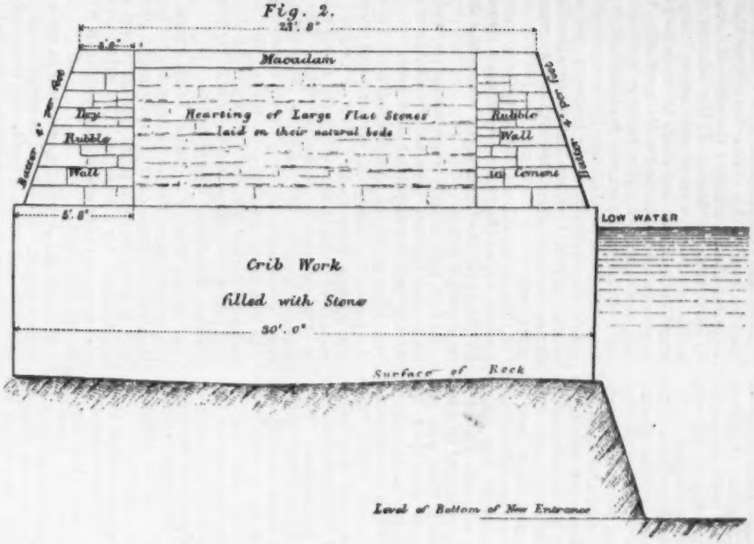
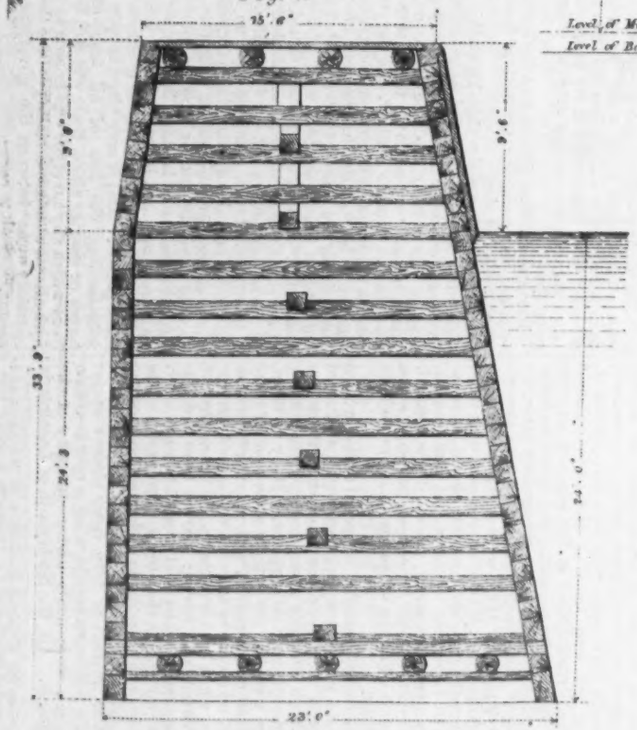


Fig. 2.



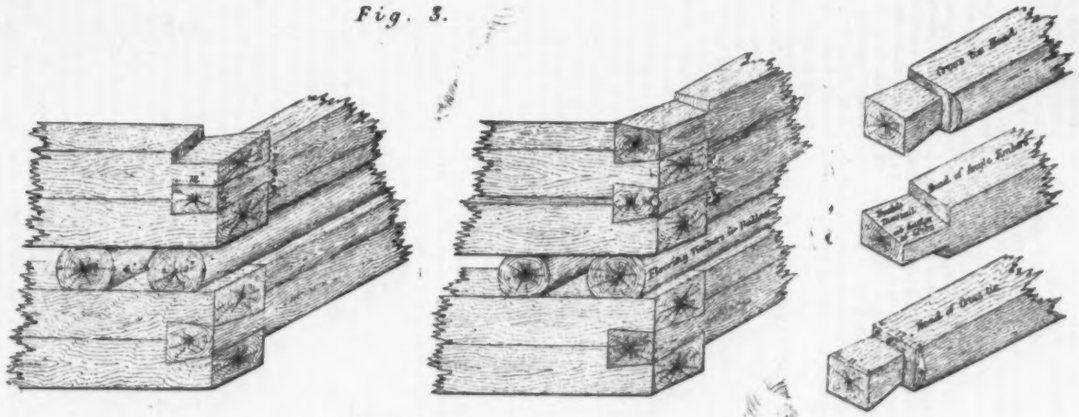
SECTIONS OF PIER AT LACHINE.

Fig. 4.



MONTREAL HARBOUR.—SECTION OF CRIB

Fig. 3.



LACHINE CANAL.—ENLARGED VIEWS OF ANGLES OF CRIBWORK.

Scale for Figs 1, 2 and 4 ½ inch = 1 Foot.
" " Fig 3 ¾ inch = 1 Foot.

ENGINEERING IN FOREIGN LANDS.

RAILROADS IN BRAZIL.

The contract for the construction of the railroad between S. Joao d'El Rei and Oliveira has been signed by the provincial government of Minas and Dr. Candido José Coelho de Moura.

The Minister of Agriculture will accompany his majesty the Emperor in his excursion on the 26th inst., as far as Carandahy, in order to inspect the works on the extension of the D. Pedro II Railroad.

The directory have determined upon the construction of a branch line from Alagoinhas, the present terminus of the English line, to Timbó in the eastern part of the province to the north of the capital. It is proposed to construct a narrow gauge line.

PUBLIC WORKS IN INDIA.

A letter has been addressed to Mr. Gladstone by Mr. Binnie, M. Inst. C. E., in which he makes an elaborate attack on the administration of the Public Works Department in India, which is well worth studying at the present time, when the Indian government is making a new departure by restricting its own new works and encouraging private enterprise. Mr. Binnie enlarges on the waste of time and energy by highly paid servants in correspondence and routine work, on the admixture of military men in the service, and other evils which make the department inefficient. Among other striking statements he asserts that from his own experience he can safely say that during fully a fifth of his service he himself was employed on work the value of which did not amount in the gross to that of the salary he drew. The reforms which Mr. Binnie advocates comprise a change in the spirit of the service, the separation of the military and civil branches, and the placing of all repairs, maintenance, etc., not requiring great engineering skill, under a local department into which natives should be largely introduced.

THE JUDICIAL FUNCTIONS OF SURVEYORS.*

BY JUSTICE COOLEY, OF THE MICHIGAN SUPREME COURT.

When a man has had a training in one of the exact sciences, where every problem within its purview is supposed to be susceptible of accurate solution, he is likely to be not a little impatient when he is told that, under some circumstances, he must recognize inaccuracies, and govern his action by facts which lead him away from the results which theoretically he ought to reach. Observation warrants us in saying that this remark may frequently be made of surveyors.

In the State of Michigan all our lands are supposed to have been surveyed once or more, and permanent monuments fixed to determine the boundaries of those who should become proprietors. The United States, as original owner, caused them all to be surveyed once by sworn officers, and as the plan of subdivision was simple, and was uniform over a large extent of territory, there should have been, with due care, few or no mistakes; and long rows of monuments should have been perfect guides to the place of any one that chanced to be missing. The truth unfortunately is that the lines were very carelessly run, the monuments inaccurately placed; and, as the recorded witnesses to these were many times wanting in permanency, it is often the case that when the monument was not correctly placed, it is impossible to determine by the record with the aid, of anything on the ground, where it was located. The incorrect record, of course, becomes worse than useless when the witnesses it refers to have disappeared.

It is, perhaps, generally supposed that our town plats were more accurately surveyed, as indeed they should have been, for in general there can have been no difficulty in making them sufficiently perfect for all practical purposes. Many of them, however, were laid out in the woods; some of them by proprietors themselves, without either chain or compass, and some by imperfectly trained surveyors, who, when land was cheap, did not appreciate the importance of having correct lines to determine boundaries when land should become dear. The fact probably is that town surveys are quite as inaccurate as those made under authority of the general government.

It is now upward of fifty years since a major part of the public surveys in what is now the State of Michigan were made under authority of the United States. Of the lands south of Lansing, it is now forty years since the major part were sold, and the work of improvement begun. A generation has passed away since they were converted into cultivated farms, and few if any of the original corner and quarter stakes now remain.

The corner and quarter stakes were often nothing but green sticks driven into the ground. Stones might be put around or over these if they were handy, but often they were not, and the witness trees must be relied upon after the stake was gone. Too often the first settlers were careless in fixing their lines with accuracy while monuments remained, and an irregular brush fence, or something equally untrustworthy, may have been relied upon to keep in mind where the blazed line once was. A fire running through this might sweep it away, and if nothing was substituted in its place, the adjoining proprietors might in a few years be found disputing over their lines, and perhaps rushing into litigation, as soon as they had occasion to cultivate the land along the boundary.

If now the disputing parties call in a surveyor, it is not likely that any one summoned would doubt or question that his duty was to find, if possible, the place of the original stakes which determined the boundary-line between the proprietors. However erroneous may have been the original survey, the monuments that were set must nevertheless govern, even though the effect be to make one half-quarter section ninety acres and the adjoining one seventy; for parties buy, or are supposed to buy, in reference to these monuments, and are entitled to what is within their lines, and no more, be it more or less. While the witness-trees remain, there can generally be no difficulty in determining the locality of the stakes.

When the witness-trees are gone, so that there is no longer record evidence of the monuments, it is remarkable how many there are who mistake altogether the duty that now devolves upon the surveyor. It is by no means uncommon that we find men, whose theoretical education is thought to make them experts, who think that when the monuments are gone the only thing to be done is to place new monuments where the old ones should have been, and would have been if placed correctly. This is a serious mistake. The problem is now the same that it was before: To ascertain, by the best lights of which the case admits, where the originals lines were. The mistake above alluded to, is supposed to have found expression in our legislation; though it is postible that the real intent of the act to which we shall refer is not what is commonly supposed.

An act passed in 1869, Compiled Laws § 593, amending the laws respecting the duties and powers of county surveyors, after providing for the case of corners which can be identified by the original field notes or other unquestionable testimony, directs as follows:

"*Second.* Extinct interior section corners must be re-established at the intersection of two right lines joining the nearest known points on the original section lines east and west and north and south of it.

"*Third.* Any extinct quarter-section corner, except on fractional lines, must be re-established equidistant and in a right line between the section corners; in all other cases at its proportionate distance between the nearest original corners on the same line."

The corners thus determined the surveyors are required to perpetuate by noting bearing trees when timber is near.

To estimate properly this legislation, we must start with the admitted and unquestionable fact that each purchaser from government bought such land as was within the original boundaries, and unquestionably owned it up to the time when the monuments became extinct. If the monument was set for an interior section corner, but did not happen to be "at the intersection of two right lines joining the nearest known points on the original section lines east and west and north and south of it," it nevertheless determined the extent of his possessions, and he gained or lost according as the mistake did or did not favor him.

It will probably be admitted that no man loses title to his land or any part thereof merely because the evidences become lost or uncertain. It may become more difficult for him to establish it as against an adverse claimant, but theoretically the right remains; and it remains as a potential fact so long as he can present better evidence than any other person. And it may often happen that notwithstanding the loss of all trace of a section corner or quarter stake, there will still be evidence from which any surveyor will be able to determine with almost absolute certainty where the original boundary was between the government subdivisions.

There are two senses in which the word extinct may be used in this connection: One the sense of physical disappearance; the other the sense of loss of all reliable evidence. If the statute speaks of extinct corners in the former sense, it is plain that a serious mistake was made in supposing that surveyors could be clothed with authority to establish new corners by an arbitrary rule in such cases. As well might the statute declare that if a man loses his deed, he shall lose his land altogether.

But if by extinct corner is meant one in respect to the actual location of which all reliable evidence is lost, then the following remarks are pertinent:

1. There would undoubtedly be a presumption in such a case that the corner was correctly fixed by the government surveyor where the field notes indicated it to be.

2. But this is only a presumption, and may be overcome by any satisfactory evidence showing that in fact it was placed elsewhere.

3. No statute can confer upon a county surveyor the power to "establish" corners, and thereby bind the parties concerned. Nor is this a question merely of conflict between State and Federal law: it is a question of property right. The original surveys must govern, and the laws under which they were made must govern, because the land was bought in reference to them; and any legislation, whether State or Federal, that should have the effect to change these, would be inoperative, because disturbing vested rights.

4. In any case of disputed lines, unless the parties concerned settle the controversy by agreement, the determination of it is necessarily a judicial act, and it must proceed upon evidence, and give full opportunity for a hearing. No arbitrary rules of survey or of evidence can be laid down whereby it can be adjudged.

The general duty of a surveyor in such a case is plain enough. He is not to assume that a monument is lost until after he has thoroughly sifted the evidence and found himself unable to trace it. Even then he should hesitate long before doing anything to the disturbance of settled possessions. Occupation, especially if long continued, often affords very satisfactory evidence of the original boundary when no other is attainable; and the surveyor should inquire when it originated, how, and why the lines were then located as they were, and whether a claim of title has always accompanied the possession, and give all the facts due force as evidence. Unfortunately, it is known that surveyors sometimes, in supposed obedience to the State statute, disregard all evidences of occupation and claim of title, and plunge whole neighborhoods into quarrels and litigation by assuming to "establish" corners at points with which the previous occupation cannot harmonize. It is often the case that where one or more corners are found to be extinct, all parties concerned have acquiesced in lines which were traced by the guidance of some other corner or landmark, which may or may not have been trustworthy; but to bring these lines into discredit when the people concerned do not question them not only breeds trouble in the neighborhood, but it must often subject the surveyor himself to annoyance and perhaps discredit, since in a legal controversy the law as well as common sense must declare that a supposed boundary line long acquiesced in is better evidence of where the real line should be than any survey made after the original monuments have disappeared. *Stewart vs. Carleton*, 31 Mich. Reports, 270; *Diehl vs. Zanger*, 39 Mich. Reports, 601. And county surveyors, no more than others, can conclude parties by their surveys.

The mischiefs of overlooking the facts of possession most often appear in cities and villages. In towns the block and lot stakes soon disappear; there are no witness trees, and no monuments to govern except such as have been put in their places, or where their places were supposed to be. The streets are likely to be soon marked off by fences, and the lots in a block will be measured off from these, without looking farther. Now it may perhaps be known in a particular case that a certan monument still remaining was the starting point in the original survey of the town plat; or a surveyor settling in the town may take some central point as the point of departure in his surveys, and, assuming the original plat to be accurate, he will then undertake to find all streets and all lots by course and distance according to the plat, measuring and estimating from his point of departure. This procedure might unsettle every line and every monument existing by acquiescence in the town; it would be very likely to change the lines of streets, and raise controversies everywhere. Yet this is what is sometimes done; the

* Read before the Michigan Association of Surveyors and Civil Engineers at meeting held at Lansing in January, 1881.

surveyor himself being the first person to raise the disturbing questions.

Suppose, for example, a particular village street has been located by acquiescence and used for many years, and the proprietors in a certain block have laid off their lots in reference to this practical location. Two lot owners quarrel, and one of them calls in a surveyor that he may make sure his neighbor shall not get an inch of land from him. This surveyor undertakes to make his survey accurate, whether the original was so or not, and the first result is, notifies the lot owners that there is error in the street line, and that all fences should be moved, say one foot to the east. Perhaps he goes on to drive stakes through the block according to this conclusion. Of course, if he is right in doing this, all lines in the village will be unsettled; but we will limit our attention to the single block. It is not likely that the lot owners generally will allow the new survey to unsettle their possessions, but there is always a probability of finding some one disposed to do so. We shall then have a lawsuit; and with what result?

It is a common error that lines do not become fixed by acquiescence in a less time than twenty years. In fact, by statute, road lines may become conclusively fixed in ten years; and there is no particular time that shall be required to conclude private owners, where it appears that they have accepted a particular line as their boundary, and all concerned have cultivated and claimed up to it. Public policy requires that such lines be not lightly disturbed, or disturbed at all, after the lapse of any considerable time. The litigant, therefore, who in such a case pins his faith on the surveyor, is likely to suffer for his reliance, and the surveyor himself to be mortified by a result that seems to impeach his judgment.

Of course nothing in what has been said can require a surveyor to conceal his own judgment, or to report the facts one way when he believes them to be another. He has no right to mislead, and he may rightfully express his opinion that an original monument was at one place, when at the same time he is satisfied that acquiescence has fixed the rights of parties as if it were at another. But he would do mischief if he were to attempt to "establish" monuments which he knew would tend to disturb settled rights; the farthest he has a right to go as an officer of the law, is to express his opinion where the monument should be, at the same time that he imparts information to those who employ him, and who might otherwise be misled, that the same authority that makes him an officer and entrusts him to make surveys, also allows parties to settle their own boundary lines, and considers acquiescence in a particular line or monument, for any considerable period, as strong if not conclusive evidence of such settlement. The peace of the community absolutely requires this rule. It is not long since, that in one of the leading cities of the State an attempt was made to move houses two or three rods into a street, on the ground that a survey under which the street had been located for many years, had been found on a more recent survey to be erroneous.

From the foregoing it will appear that the duty of the surveyor, where boundaries are in dispute, must be varied by circumstances. 1. He is to search for original monuments, or for the places where they were originally located, and allow these to control if he finds them, unless he has reason to believe that agreements of the parties, express or implied, have rendered them unimportant. By monuments in the case of government surveys we mean of course the corner and quarter stakes; blazed lines or marked trees on the lines are not monuments: they are merely guides or finger posts, if we may use the expression, to inform us with more or less accuracy where the monuments may be found. 2. If the original monuments are no longer discoverable, the question of location becomes one of evidence merely. It is merely idle for any State statute to direct a surveyor to locate or "establish" a corner, as the place of the original monument, according to some inflexible rule. The surveyor, on the other hand, must inquire into all the facts, giving due prominence to the acts of parties concerned, and always keeping in mind, *first*, that neither his opinion nor his survey can be conclusive upon parties concerned; and, *second*, that courts and juries may be required to follow after the surveyor over the same ground, and that it is exceedingly desirable that he govern his action by the same lights and the same rules that will govern theirs.

It is always possible when corners are extinct that the surveyor may usefully act as a mediator between parties, and assist in preventing legal controversies by settling doubtful lines. Unless he is made for this purpose an arbitrator by legal submission, the parties, of course, even if they consent to follow his judgment, cannot on the basis of mere consent be compelled to do so; but if he brings about an agreement, and they carry it into effect by actually conforming their occupation to his lines, the action will conclude them. Of course, it is desirable that all such agreements be reduced to writing; but this is not absolutely indispensable if they are carried into effect without.

Meander lines.—The subject to which allusion will now be made is taken up with some reluctance, because it is believed the general rules are familiar. Nevertheless it is often found that surveyors misapprehend them, or err in their application, and as other interesting topics are somewhat connected with this, a little time devoted to it will probably not be altogether lost. The subject is that of meander lines. These are lines traced along the shores of lakes, ponds and considerable rivers as the measures of quantity when sections are made fractional by such waters. These have determined the price to be paid when government lands were bought, and perhaps the impression still lingers in some minds that the meander lines are boundary lines, and all in front of them remains unsold. Of course this is erroneous. There was never any doubt that, except on the large navigable rivers, the boundary of the owners of the banks is the middle line of the river; and while some courts have held that this was the rule on all fresh-water streams, large and small, others have held to the doctrine that the title to the bed of the stream below low-water mark is in the State, while conceding to the owners of the banks all riparian rights. The practical difference is not very important. In this State the rule that the center line is the boundary line is applied to all our great rivers, including the Detroit, varied somewhat by the circumstance of there being a distinct channel for navigation in some cases with the stream in the main shallow, and also sometimes by the existence of islands.

The troublesome questions for surveyors present themselves when the boundary line between two contiguous estates is to be continued, from the meander line to the center line of the river. Of course the original survey supposes that each purchaser of land on the stream has a water front of the length shown by the field notes; and it is presumable that he bought this particular land because of that fact. In many cases it now happens that the meander line is left some distance from the shore by the gradual change of course of the stream, or diminution of the flow of water. Now the dividing line between two government subdivisions might strike the meander line at right angles, or obliquely; and, in some cases, if it were continued in the same direction to the center line of the river, might cut off from the water one of the subdivisions entirely, or at least cut it off from any privilege of navigation, or other valuable use of the water, while the other might have a water front much greater than the length of a line crossing it at right angles to its side lines. The effect might be that of two government subdivisions of equal size and cost, one would be of very great value as water-front property, and the other comparatively valueless. A rule which would produce this result would not be just, and it has not been recognized in the law.

Nevertheless, it is not easy to determine what ought to be the correct rule for every case. If the river has a straight course, or one nearly so, every man's equities will be preserved by this rule: Extend the line of division between the two parcels from the meander line to the center line of the river, as nearly as possible at right angles to the general course of the river at that point. This will preserve to each man the water front which the field notes indicated, except as changes in the water may have affected it, and the only inconvenience will be that the division line between different subdivisions is likely to be more or less deflected where it strikes the meander line.

This is the legal rule, and it is not limited to government surveys, but applies as well to water lots which appear as such on town plats. *Bay City Gas Light Co. vs. The Industrial Works*, 28 Mich. Reports, 182. It often happens, therefore, that the lines of city lots bounded on navigable streams are deflected as they strike the bank, or the line where the bank was when the town was first laid out.

When the stream is very crooked, and especially if there are short bends, so that the foregoing rule is incapable of strict application, it is sometimes very difficult to determine what shall be done; and in many cases the surveyor may be under the necessity of working out a rule for himself. Of course his action cannot be conclusive; but if he adopts one that follows as nearly as the circumstances will admit, the general rule above indicated, so as to divide as near as may be the bed of the stream among the adjoining owners in proportion to their lines upon the shore, his division, being that of an expert, made upon the ground and with all available lights, is likely to be adopted as law for the case. Judicial decisions, into which the surveyor would find it prudent to look under such circumstances, will throw light upon his duties and may constitute a sufficient guide when peculiar cases arise. Each riparian lot owner ought to have a line on the legal boundary, namely, the center line of the stream, proportioned to the length of his line on the shore; and the problem in each case is, how this is to be given him. Alluvion, when a river imperceptibly changes its course, will be apportioned by the same rules.

The existence of islands in a stream when the middle line constitutes a boundary, will not affect the apportionment unless the islands were surveyed out as government subdivisions in the original admeasurement. Wherever that was the case, the purchaser of the island divides the bed of the stream on each side with the owner of the bank, and his rights also extend above and below the solid ground, and are limited by the peculiarities of the bed and the channel. If an island was not surveyed as a government subdivision previous to the sale of the bank, it is, of course, impossible to do this for the purposes of government sale afterward, for the reason that the rights of the bank owners are fixed by their purchase; when making that, they have a right to understand that all land between the meander lines, not separately surveyed and sold, will pass with the shore in the government sale; and, having this right, anything which their purchase would include under it cannot afterward be taken from them. It is believed, however, that the federal courts would not recognize the applicability of this rule to large navigable rivers, such as those uniting the great lakes.

On all the little lakes of the State which are mere expansions near their mouths of the rivers passing through them—such as the Muskegon, Pere Marquette and Manistee—the same rule of bed ownership has been judicially applied that is applied to the rivers themselves; and the division lines are extended under the water in the same way. *Rice vs. Ruddiman*, 10 Mich., 125. If such a lake were circular, the lines would converge to the center; if oblong or irregular, there might be a line in the middle on which they would terminate, whose course would bear some relation to that of the shore. But it can seldom be important to follow the division line very far under the water, since all private rights are subject to the public rights of navigation and other use, and any private use of the lands inconsistent with these would be a nuisance, and punishable as such. It sometimes important, however, to run the lines out for some considerable distance, in order to determine where one may lawfully moor vessels or rafts, for the winter, or cut ice. The ice crop that forms over a man's land of course belongs to him. *Lorman vs. Benson*, 8 Mich., 18; *Peoples' Ice Co. vs. Steamer Excelsior*, recently decided.

What is said above will show how unfounded is the notion, which is sometimes advanced, that a riparian proprietor on a meandered river may lawfully raise the water in the stream without liability to the proprietors above, provided he does not raise it so that it overflows the meander line. The real fact is that the meander line has nothing to do with such a case, and an action will lie whenever he sets back the water upon the proprietor above, whether the overflow be below the meander lines or above them.

As regards the lakes and ponds of the State, one may easily raise questions that it would be impossible for him to settle. Let us suggest a few questions, some of which are easily answered, and some not:

1. To whom belongs the land under these bodies of water, where they are not mere expansions of a stream flowing through them?

2. What public rights exist in them?

3. If there are islands in them which were not surveyed out and sold by the United States, can this be done now?

Others will be suggested by the answers given to these.

It seems obvious that the rules of private ownership which are applied to rivers cannot be applied to the great lakes. Perhaps it should be held that the boundary is at low-water mark, but improvements beyond this would only become unlawful when they became nuisances. Islands in the great lakes would belong to the United States until sold, and might be surveyed and measured for sale at any time. The right to take fish in the lakes, or to cut ice, is public like the right of navigation,

U of M

but is to be exercised in such manner as not to interfere with the rights of shore owners. But so far as these public rights can be the subject of ownership, they belong to the State, not to the United States; and so, it is believed, does the bed of a lake also. *Pollard v. Hagen*, 3 Howard's U. S. Reports. But such rights are not generally considered proper subjects of sale, but like the right to make use of the public highways, they are held by the State in trust for all the people.

What is said of the large lakes may perhaps be said also of many of the interior lakes of the State; such, for example, as Houghton, Higgins, Cheboygan, Burt's, Mullet, Whitmore and many others. But there are many little lakes or ponds which are gradually disappearing, and the shore proprietorship advances *pari passu* as the waters recede. If these are of any considerable size—say even a mile across—there may be questions of conflicting rights which no adjudication hitherto made could settle. Let any surveyor, for example, take the case of a pond of irregular form, occupying a mile square or more of territory, and undertake to determine the rights of the shore proprietors to its bed when it shall totally disappear, and he will find he is in the midst of problems such as probably he has never grappled with or reflected upon before. But the general rules for the extension of shore lines, which have already been laid down, should govern such cases, or at least should serve as guides in their settlement.

Where a pond is so small as to be included within the lines of a private purchase from the government, it is not believed the public have any rights in it whatever. Were it not so included, it is believed they have rights of fishery, rights to take ice and water and rights of navigation for business or pleasure. This is the common belief, and probably the just one. Shore rights must not be so exercised as to disturb these, and the States may pass all proper laws for their protection. It would be easy with suitable legislation to preserve these little bodies of water as permanent places of resort for the pleasure and recreation of the people, and there ought to be such legislation.

If the State should be recognized as owner of the beds of these small lakes and ponds, it would not be owner for the purpose of selling. It would be owner only as trustee for the public use; and a sale would be inconsistent with the right of the bank owners to make use of the water in its natural condition in connection with their estates. Some of them might be made salable lands by draining; but the State could not drain, even for this purpose, against the will of the shore owners, unless their rights were appropriated and paid for.

Upon many questions that might arise between the State as owner of the bed of a little lake and the shore owners, it would be presumptuous to express an opinion now, and, fortunately, the occasion does not require it.

I have thus indicated a few of the questions with which surveyors may now and then have occasion to deal, and to which they should bring good sense and sound judgment. Surveyors are not and cannot be judicial officers, but in a great many cases they act in a *quasi* judicial capacity, with the acquiescence of parties concerned; and it is important for them to know by what rules they are to be guided in the discharge of their judicial functions. What I have said cannot contribute much to their enlightenment, but, I trust, will not be wholly without value.

FIRST ANNUAL CONVENTION OF THE AMERICAN WATER-WORKS ASSOCIATION.

ENGINEERS' HALL, WASHINGTON UNIVERSITY,
ST. LOUIS, Mo., March 29, 1881.

Pursuant to a call issued by W. C. Stripe, Secretary and Superintendent Keokuk Water Company, the following officers of water companies, and those interested, met in convention.

W. C. Stripe, Secretary, Engineer Water-works, Keokuk, Iowa; H. G. Belche, Collecter Water Rates, Peoria, Ill.; James Millard, Peoria; M. Donohue, President Water-works, Davenport, Iowa; Alex. Miller, Davenport, Iowa; Ira A. Holly, Superintendent Water-works, Burlington, Iowa; M. X. Chuse, Superintendent Water-works, Bloomington, Ill.; Charles A. Smith, Professor Washington University, St. Louis; J. H. Becker, Superintendent Water-works, Hannibal, Mo.; H. D. Wood, Secretary and Treasurer Hannibal Water-works; J. G. Briggs, Superintendent Water-works, Terre Haute, Ind.; John W. Harrison, of Shickle, Harrison & Co., St. Louis; John Long, of Dennis, Long & Co., Louisville, Ky.; F. L. Kimball, of Ripley & Kimball, St. Louis; Sylvester Watts, water-works builder, St. Louis; J. B. Quigley, Superintendent Water-works, Atchison, Kan.; Wm. H. Burnham, general agent U. S. Wind-Engine and Pump Co., Batavia, Ill.; W. L. Cameron, Secretary and Superintendent Water-works, Memphis, Tenn.; T. J. Rembert, Contracting Agent Mobile & Ohio Railroad; C. E. Gray, water-works builder, St. Louis; Wm. Ratekin, Superintendent Water-works, Jacksonville, Ill., and Col. J. T. Foster, civil and hydraulic engineer, Superintendent Lake Water-works, Union Stock-yards, Chicago.

At 10.30 a. m. the Convention was called to order by Mr. Stripe, who gave a short statement of the causes leading to the call.

On motion of H. D. Wood, J. T. Foster, of Chicago, was elected President.

On motion of Sylvester Watts, J. H. Decker, of Hannibal, was elected Secretary.

On motion of Ira A. Holly, H. D. Wood, of St. Louis, was elected Treasurer.

On motion of H. D. Wood and Sylvester Watts, W. C. Stripe, of Keokuk, and Prof. Chas. A. Smith, of St. Louis, were elected First and Second Vice-Presidents, respectively.

Col. Foster, on taking the chair, alluded pointedly and briefly to the business before the body, and suggested that great benefit would ensue from an interchange of views on the subject of water-works. These institutions differed so much that all had something to learn and something to impart. He suggested that a history of water-works be given, with the various improvements made from time to time, and that each member describe the particular works with which he was connected.

On motion of Sylvester Watts, the temporary organization was made permanent.

On motion of Mr. Watts, a committee was appointed to draft a constitution and by-laws, with rules of order, and they were instructed to report at 10 a. m. Wednesday, March 30.

On motion of J. W. Harrison, the committee was made to consist of five (5) members, and appointed by the chair.

The chair appointed the following as the committee:

Sylvester Watts, St. Louis, Mo.
W. L. Cameron, Memphis, Tenn.
W. C. Stripe, Keokuk, Ia.
Ira A. Holly, Burlington, Ia.
J. G. Briggs, Terre Haute, Ind.

On motion of W. C. Stripe, a committee of three (3) was appointed and instructed to report at once subjects for to-morrow's discussion. The Chair appointed the following committee:

W. C. Stripe, Keokuk, Ia.,
M. X. Chuse, Bloomington, Ill.,
J. B. Quigley, Atchison, Ks.,

Who retired to make up their report.

During the absence of the committee, President Foster presented a profile showing the results obtained at his works, viz.:

1. Duty in foot pounds.
2. Gallons pumped per day.
3. Water pressure in discharge main.
4. Vacuum on induction main.
5. Evaporation in pounds of water generated into steam, per pound of coal.
6. Coal burned per day in pounds; and gave quite a detailed account of the working of the Lake Water-works. Quite a number of questions were propounded by different members, which were satisfactorily answered. The Committee on Subjects for Discussion having returned to the hall, they presented the following report:

LIST OF SUBJECTS FOR DISCUSSION.

Fuel.

1. Per million gallons raised one foot high; Firing; Consumption of Smoke; Coal vs. Wood, Corncobs, Oil, or Gas.

Mains.

2. Depth in the Ground; Iron, Wood, or Cement.

Service Pipes.

3. Plain Iron; Varnished Iron; Galvanized Iron, or Lead.
4. Rates; Motors; Meters; Water Closets; Fountains; Bath-Rooms; Sprinkling.

Waste.

5. (The Committee called attention to this.)
6. Fire Hydrants; Freezing; Thawing.
7. "Ellis Tables;" has any one verified them? *Various systems.*
8. Direct Pressure; Stand-Pipe Reservoir, and Elevated Reservoir.
9. Why not make sleeves in two parts, with lugs and bolts, and thus obviate the necessity of taking up two lengths of pipe and three joints to repair a small break?
10. Work of Plumbers.

(Signed.) W. C. STRIPE,
Chairman of Committee.

On motion of H. D. Wood the report of the committee was adopted.

Jno. W. Harrison, of the Shickle, Harrison & Howard Iron Co., extended an invitation to the Convention to visit their Cast-Iron Pipe Works. On motion of Mr. Holly, those desiring to inspect the works were to meet there at 9 o'clock a. m., Wednesday. President Foster here stated that the Convention would not be bound exclusively to the subjects presented by the committee for discussion, but that all matters germaine to the water supply might be fully discussed.

On motion of a member all persons interested in the subject of water, whether ladies or gentlemen, were invited to attend the session of the Convention.

On motion, adjourned to meet at 10 o'clock a. m. Wednesday, March 30.

SECOND DAY, WEDNESDAY, MARCH 30.

MORNING SESSION.

Convention met at 10:45 o'clock, with Vice-President Chas. A. Smith in the chair.

The journal of Tuesday's proceedings were read, and, on motion, approved.

The Committee on Constitution and By-laws, through the chairman, Sylvester Watts, presented the following preamble, constitution and by-laws for the consideration of the convention:

PREAMBLE.

We, the undersigned, desirous of forming an Association for the exchange of information pertaining to the management of water-works, for the mutual advancement of consumers and water companies, and for the purpose of securing economy and uniformity in the operation of water works, do hereby associate and adopt the following constitution and by-laws.

CONSTITUTION.

ARTICLE II.—NAME.

The name of the Association shall be The American Water-Works Association.

ARTICLE II.—OFFICERS.

SEC. 1. The officers of this Association shall consist of a President, five Vice-Presidents (who shall respectively be residents of different States), a Secretary and a Treasurer. All the above officers shall be elected annually by ballot, and shall serve for one year, or until their successors are elected.

SEC. 2. The President shall preside at all meetings In his absence one of the Vice-Presidents shall preside.

SEC. 3. The officers of this Association shall, ex-officio, constitute an Executive Committee.

SEC. 4. The Executive Committee shall have control of the property and management of the affairs of the Association, shall provide suitable rooms for all annual meetings, may suggest topics for discussion, and shall have power to expend the funds of the Association; provided, that no indebtedness shall be incurred exceeding the amount of the funds in the hands of the Treasurer. It shall have power to call special meetings of the Association.

SEC. 5. The Secretary shall keep the minutes of all meetings, conduct all correspondence, receipt for all fees and dues, and turn over to the Treasurer all moneys received, taking his receipt therefor.

He shall have such compensation as the Executive Committee may determine.

SEC. 6. It shall be the duty of the Treasurer to receive from the Secretary all money for the Association; to keep correct accounts of all receipts and expenditures, and to pay all demands against the Association when approved by the President. At the annual meeting he shall exhibit a statement of his accounts. The Treasurer shall give such bond as may be required by the Executive Committee.

ARTICLE III.—MEMBERSHIP.

All persons connected with the construction and management of water-works shall be eligible for membership. Any person applying for membership shall make a written application to the Secretary, stating his name, age, residence, business and position, accompanying his application with the regular initiation fee. The Secretary shall refer each application to the President, and, with the latter's approval, shall issue a certificate of membership.

ARTICLE IV —AMENDMENTS.

Amendments to this Constitution and By-Laws may be made at any regular meeting, by a vote of two-thirds of the members present.

BY-LAWS.

ARTICLE I.—MEETINGS.

The annual meeting of the Association, for the election of officers and the transaction of business, shall be held on the third Tuesday in March of each year. At each annual meeting the place for holding the subsequent meeting shall be determined by ballot.

ARTICLE II.—ORDER OF BUSINESS.

The President shall take the chair at the appointed hour, and the order of business shall be as follows:

1st. Call of roll.
2d. Reading of minutes of last meeting.
3d. Reading of all letters and communications.
4th. Reports of Secretary, Treasurer and Committees.
5th. Unfinished business.
6th. New business.

ARTICLE III.—DUES AND FEES.

The initiation fee shall be five dollars.

The annual dues shall be two dollars, payable in advance.

(Signed.) SYLVESTER WATTS,
W. L. CAMERON,
IRA A. HOLLY,
J. G. BRIGGS,
Committee.

On motion of Mr. Ratekin the report was received, and considered seriatim.

Preamble read and on motion adopted without debate.

Article I. read and on motion adopted without debate.

Article II., Sec. 1st, read and on motion adopted without debate.

Article II., Sec. 2d, read and on motion adopted without debate.

Article II., Sec. 3d, read and on motion adopted without debate.

Article II., Sec. 4th, read and on motion adopted without debate.

Article II., Sec. 5th, read and on motion adopted without debate.

Article II., Sec. 6th, read and on motion adopted without debate.

Article III. elicited a long discussion which was opened by the Secretary objecting to the unlimited power vested in the President of the Association, in allowing him to decide who shall become members of the Association, and who should not, but his objections were silenced by the statement from the Chairman of the Committee that the objectionable clause was intended only for the interim of meetings. Mr. Harrison expressed the opinion that the article restricted the membership to the officers and constructors of water-works only, and debarred from membership manufacturers of material whose ideas would be of some value in the deliberations.

Mr. Belcke, of Peoria, agreed with him, and stated that it left the way open for the pipe-layer, the trencher, or any laborer employed in the construction of the works, and debarred the manufacturer, the collector and the inspector, the parties whose experience made their ideas the most valuable to the Association.

Now followed quite a running discussion, which was participated in by nearly all present.

Mr. Watts, Chairman of the Committee, stated that the article should be accepted in its broadest sense, and that it was not likely that those whose interests were identical would be debarred.

Mr. Briggs, of Terre Haute, offered the following amendment:

"That all persons or firms engaged in furnishing material for the construction and maintenance of water-works, desiring to join the Association, may be admitted as honorary members by the usual form, on the payment of an initiation fee of ten dollars, and be entitled to one representative at each meeting,"

which was, upon motion of Ira A. Holly, adopted as Sec. 2 of Article III., and the article as amended, on motion, was adopted.

Article IV. read, and, on motion of the Secretary, the words "must be in writing" inserted after "by-laws" in the second line, making it read: "Amendments to this Constitution and By-laws must be in writing, and may be made at any regular meeting by a two-thirds vote of the members present," and was, on motion, adopted as amended.

BY-LAWS.

Article I. read and amended on motion of the Secretary, by substituting the *second* Tuesday in March for the "third" Tuesday, as it would not then interfere so much with the duties of those who made quarterly and monthly collections by coming so close to collection time, and on motion the article was adopted as amended.

Article II. read, and adopted without debate.

Article III. elicited some discussion as to whether a member should be required to pay the initiation fee of five dollars, and then pay the two dollars dues in advance on top of that. The Chair suggested that the elimination of the words "payable in advance" would straighten the matter. Mr. Holly moved they be sticken out, which was carried, and the article then adopted as amended.

The motion of Mr. Cameron, that the report as now amended be adopted as a whole, was carried unanimously.

An opportunity now being given to sign the constitution and pay the initiation, it was embraced by the following:

Sylvester Watts, gas and water-works builder, St. Louis, Mo.
J. G. Briggs, Superintendent Water-works, Terre Haute, Ind.
W. C. Stripe, Secretary and Superintendent Water-works, Keokuk, Ia.
Ira A. Holly, Superintendent and Engineer Water-works, Burlington, Ia.
H. G. Belcke, Secretary and Collector Water-works, Peoria, Ill.
J. B. Quigley, Superintendent Water-works, Atchison, Kan.
M. X. Chuse, Superintendent Water-works, Bloomington, Ill.
W. Donohue, President Water-works, Davenport, Ia.
Wm. Ratekin, Superintendent Water-works, Jacksonville, Fla.
W. L. Cameron, Secretary and Superintendent Water-works, Memphis, Tenn.
Thos. J. Whitman, Commissioner Water-works, St. Louis, Mo.
W. L. Holman, Assistant Commissioner Water-works, St. Louis, Mo.
J. H. Decker, Superintendent and Engineer Water-works, Hannibal, Mo.
J. F. Foster, Superintendent Lake Water-works, Chicago, Ill.
H. D. Wood, Secretary and Treasurer Water-works, Hannibal, Mo.
Chas. A. Smith, Prof. C. and Mech. Eng. Washington University, St. Louis, Mo.
John P. Haley, Civil and Hydraulic Engineer, St. Louis, Mo.
F. Wm. Raeder, Architect and Consulting Engineer, St. Louis, Mo.
Wm. H. Burnham, General Agent, Batavia, Ill.

And the following as honorary members:

Shickle, Harrison & Howard Iron Co., St. Louis, Mo.
Dennis Long & Co., Louisville, Ky.
H. C. Nelson & Co., St. Louis, Mo.
Ripley and Kimball, St. Louis, Mo..

Professor Smith, after first stating that as at Tuesday's session there had been an election of permanent officers, and as the constitution provided for an additional number, in order to avoid a conflict he moved a full election be entered into. Upon the motion being seconded, it was put and carried. President Foster, having taken the chair, appointed Mr. Watts teller. The following were nominated as the officers of the Association for the ensuing year:

President, Col. J. T. Foster, of Chicago, Ill. Vice-Presidents, Wm. C. Stripe, of Keokuk, Ia.; Prof. Chas. A. Smith, of St. Louis, Mo.; W. L. Cameron, of Memphis, Tenn.; M. X. Chuse, of Bloomington, Ill.; J. G. Briggs, of Terre Haute, Ind. Treasurer, H. D. Wood, of Hannibal, Mo. Secretary, J. H. Decker, of Hannibal, Mo.

On motion, the Teller was instructed to cast the vote of the Association for above-named nominees, and they were thereupon declared elected.

On motion, the Association selected the place of holding the next annual meeting.

On motion, a viva voce vote be taken to ascertain the views of the members; upon the call of the roll the choice stood thus:

	Votes.		Votes.
Cincinnati, Ohio	4	Chicago, Ill	8
Columbus, Ohio	6	Indianapolis, Ind	7
Terre Haute, Ind	1	Leavenworth, Kan	1
Davenport, Ia	1		

On motion of J. W. Harrison, the three cities receiving the highest number of votes, viz., Chicago, Columbus and Cincinnati, were placed in nomination. Mr. Watts was continued as Teller, and proceeded to ballot with following result:

FIRST BALLOT.

Columbus, 12 votes.
Chicago, 12 votes.

There being more votes cast than members present, a new ballot was ordered, and each member instructed to sign his name to his ballot.

SECOND BALLOT.

Columbus, 12 votes.
Chicago, 9 votes.

On motion, the vote for Columbus to be declared unanimous was carried.

Col. Thos. J. Whitman extended an invitation to the Association to visit the St. Louis water-works after noon. Mr. Harrison stated that the manufacturers and merchants of the city had provided carriages, which were at the pleasure of the Association. A motion was made to accept the invitation and meet at the Lindell Hotel at 2:30 p. m. The Secretary suggested that, as the sessions were being somewhat prolonged, and that probably many of the members would leave for home Thursday morning, it would be best to continue business sessions to a close, and spend Thursday in visiting. A call of the roll was ordered to determine how many members would remain for Thursday's sessions, providing the pending motion be carried, and resulted in a unanimous vote to remain; the motion was then put and carried unanimously.

The motion, that when the Convention adjourn it adjourn to meet at the Hall, at 8 p.m., for discussion of the topics as presented by the Committee was passed.

Mr. Hunt, representing Furney's Patent Water Regulator, stated that he had one placed in the Manuel Training School of the University, and would be pleased to have the members examine it after adjournment.

The hour being past noon the Convention, on motion, adjourned.

(TO BE CONTINUED.)

A PROBLEM FOR SANITARIANS.

A correspondent of the *Pall Mall Budget*, writing from the west of Ireland, gives the following account of

THE HOUSES OF CONNEMARA.

"I am not squeamish or easily scared by repulsive smells and sights, but what I saw yesterday and the day before brought me as near losing self-possession as ever happened in my life. Not only words, but the painter's brush would be inadequate to render the horror of those dens of foulness in which many of our fellow subjects toward the close of the nineteenth century still live. I visited some score or so each day; and there are degrees of squalor and abomination, even at this zero of human existence. For instance, some of the cabins had a chimney, and the smoke of the turf fire positively went up it instead of finding its way out by the door. But this was the exception. I do not remember one window. What light entered came in by the door. But that was not much; for the air was generally so charged with smoke that a step or two inside placed you in comparative darkness. 'Sit down or you will be smothered,' said my guide in one of the worst of the cabins. I did not at once realize the propriety, even to avoid suffocation, of sitting down on the mud floor which I shall presently describe; but I soon saw dimly through the smoke that friendly little hands of children were offering me a low stool, on which (in Irish) they invited me to sit. At the lower elevation I could see with comparative clearness, as the smoke did not reach quite to the ground. How any human eyes and lungs can endure such an atmosphere is a problem I am unable to solve. But all the cabins were not full of smoke; in some the fire was low or out, and in them I was able to notice a condition of things which I utterly despair of conveying to the reader.

The air inside is that of a drain, mingled with the compound odors of a menagerie and dissecting room. The walls are just the undressed stones of the neighboring dikes, put together without mortar or cement. The floor is a compound of mud and manure, which is easily explained by the presence of pigs, poultry, and occasionally a donkey, as members of the household. Rills of water traversed the tenement or stagnated in pools, according to the slope of the ground. Of furniture there was little to be seen—at the utmost a chair and a dresser, with a few plates. Bedsteads and bedding only existed in the form of sacks, either on the ground or on rude boards but little above it. In one cabin the tenant for the last two nights had been unable to occupy his sleeping lair, compared to which a London coal cellar is a palace. I saw the spot, and you might as well have tried to sleep in the bed of a brook. A little way further up I was informed that people might be found quite recently sleeping in *bog mould*, but now they have obtained potato sacks. The murky, brown, reeking, fetid gloom and horror of these interiors are not in the least suggested by these details. The *tout ensemble* is beyond description, as it almost baffles memory, so incredible and awful does it appear the moment you are out of it.

The dwellers in these cabins are superior to their habitations. Lusty, broad-shouldered men, and well-grown, even comely women, and healthy-looking children may be seen in them. It is true that the clothes of the men and children are a wonder to behold. Thick patches of cloth and sacking, unaccountably suspended and kept in place, with large discs of naked flesh exposed between them—a costume half Robinson Crusoe, half Red Indian—prevailed among the classes just named. The women were far more decently clad. Yet there were exceptions even among the women. In one particularly dismal hovel which, owing to the absence of smoke, I could examine with more accuracy, an aged woman, who was ill, crouching close to the embers of an expiring peat fire, seemed as nearly naked as the few rags attached to her would allow. I have no wish to excite odium against classes, but it happens that the husband of this poor creature paid rent to a peer of the realm, and his rent had been raised. Three pounds a year at first, it had been advanced to £3 15s.; and for a piece of uncultivated land which he had reclaimed he now had to pay £1 per annum." M.

It would be interesting to know on what theory a modern sanitarian would undertake to reconcile the superior health of the occupants of these cabins, with the foul air they must breathe for at least one half of their lives.

UofM

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

There are forty laborers at work on the site of the reservoir for increased water supply for New York from the water shed of the Bronx River at Kensico, Westchester county. This force will soon be increased to 400.

The Pierce Well Excavator Co., 29 Rose street, this city, report a constantly increasing trade in their line, and are now doing business therein all over the civilized world, they recently having had large orders from Portugal, South Africa, Australia and New Zealand. Among other work in this country they have lately sunk a well for the Waterloo Woolen Manufacturing Co., of Waterloo, N. Y., 156 ft. deep and 6 in. in diameter, which is constantly flowing about 500,000 gallons each 24 hours; also, a well for J. C. Jessup & Co., of this city, manufacturers of water colors, at their works at Dighton, Mass., and several others at the works of the National Rubber Co., at Bristol, R. I. The Pierce wells are sunk with a portable horse power machine, which costs from $700 to $800, and are stated to be particularly adapted for use wherever a large quantity of water is required, at small cost, and to possess advantages, especially in that particular, over any system of wells heretofore or at present in use.

ELECTRICITY.

One mile square of Akron is lighted by electric lights. The lights are located on an iron tower at the corner of Howard and Market streets, 208 feet high, and on the steeple of Bechtel College, 146 feet high. They were started at 2 o'clock on Saturday morning, and are entirely satisfactory. There are four lamps on each tower of 1,600 candle power each. The entire cost of the outfit was about $8,000.

Prof. Perry, speaking before the London Society of Arts, said he looked upon existing machines as having served a special purpose, and as soon to be put into the background by huge machines driven by huge engines at the mouths, even if not at the bottom, of the coal-pits themselves, and the energy thus obtained sent by means of wires in every direction, and utilized at the points where it was required. He maintained, with Professor Ayrton, that it was possible, with small wires, to transmit from one point to a distance the energy derivable from natural sources, such as the Falls of Niagara, and so to use the power now wasted. Speaking of the future of electrical railways, he concluded that the introduction of such railways everywhere is merely a question of capital, and the sacrificing of a certain quantity of existing plant. Electrical railways would be more economical than steam railways, because, for example, the rolling stock would be so much lighter. There would be no heavy engines, and the wear and tear being so much less the weight of the steel rails might be considerably reduced, so that bridges, permanent way, etc., would cost far less than at present. A brief reference was made to the question of storing up the energy which might be obtained by taking advantage in many places of the ever-recurring actions of the tides. Professor Perry showed that the electrial energy could be stored up, and that the accumulation so obtained might be used as required. We are well aware that we may be on the eve of wonderful application of this imponderable substance, and it would be well if those engaged in harbor works, in works on tidal rivers, and such like natural positions, were to consider the desirability of making the attempt to use the energy which these sanguine electricians says is awaiting their call. If a small part only of the future prospect of electrical application as foreshadowed by Professor Perry is realized, we shall have as great a revolution in the world's history as steam itself caused.

BRIDGES.

General Negley was lately at Youngstown to make an arrangement with Brown, Bonnell & Co., and the Himrod Furnace Company, to build a bridge across the Beaver River at Wampum. These two iron companies, in conjunction with the Pittsburgh, New Castle & Lake Erie Railroad, are expected to do the work. The object is to run a railroad into the coal fields of Lawrence County.

RAILROADS.

The New York Central, it is reported, intends to add considerably to the road in third and fourth tracks from Rochester to Buffalo.

The Detroit extension of the Columbus & Toledo Railroad is a thing of the near future. This will connect Detroit with the Hocking Valley coal regions, and with the lake commerce of Detroit.

The old Denison & Pacific Railroad, now a branch of the Missouri Pacific, is to be extended at once from Gainsville to the main line of the Texas and Pacific road. Graders begin work immediately.

TORONTO, April 7.—Colonel Cumberland, Managing Director of the Northern Railway, has gone to England to make financial arrangements for changing the gauge of that line to the standard gauge.

The first two sections of the Jackson, Lansing & Saginaw Railroad extension from Gaylord, twenty miles north, are completed. The contractor, A. D. McDonald, is now employing about 500 men, and expects in a short time to double the force.

ST. LOUIS, April 8.—The Wabash Railway has acquired the Havana, Rantoul & Eastern Railroad, a narrow-gauge line seventy-six miles long, running from Leroy, Ill, to West Lebanon, Ind., and it will be incorporated into the Wabash system.

The Nantucket Railroad Company, of Massachusetts, announces that the road-bed is nearly finished, and that the ties are on the ground. It will be completed in time to accommodate this summer's visitors. The road runs from Nantucket across the island to the south shore, and then along the coast to Siasconset, about 10¼ miles, and will be three feet in gauge.

The Board of Public Works of Virginia has paid to the Richmond & Allegheny Railroad Company the third installment of $100,000 on account of fifty miles additional road completed. This company has now in operation 150 miles, which has been constructed in about 150 working days, and the road is being pushed to completion with great rapidity.

The Denver & Rio Grande Railroad is extending the Corpus Christi and Laredo Railroad, which it a short time since purchased, and which reaches 60 miles west of Corpus Christi, to a connection with the Mexican National at Laredo, TEX. The final object is said to be the extension of the Rio Grande's Colorado system to Laredo, thus giving them direct connection with the Gulf of Mexico and the Pacific coast.

The government surveys for the Canada Pacific Railroad through Baptist City and Minnesota have both been abandoned, owing to the difficulty attending construction, and a southern route chosen which crosses the Assinboine at Grand Valley, nine miles below the Little Saskatchewan River. It then passes the Cough Valley, lying between the Loures and Assinboine rivers. This route will give an easy grade.

CHICAGO, April 11.—Ex-Governor John Evans, president of the Denver & New Orleans Railroad Company, was in this city to-day on his way to New York, where he goes to consult Jay Gould about the construction of the Denver & New Orleans Railroad. He has just bought 150 miles of steel rails for the road. He says the construction of the road from Denver to form a connection with the Gould system will be pushed energetically.

The Short Line Company has purchased the Louisville & Harrods Creek Narrow-Gauge Railroad. They will convert it into a broad gauge, and extend it along the river to Westport, Ky., this spring, and from there to Milton, Ky., opposite Madison, Ind. If the road is a success it will, it is said, be extended along the Kentucky shore to Covington. The Company has already contracted for ties for a portion of the new road.

The survey for the proposed rapid transit railway on Staten Island, N. Y., will soon be completed. The promoters of the scheme are seeking to obtain from the Legislature a grant for the right of way in front of the Seaman's Retreat at Stapleton and in front of the Health Officer's grounds at Clifton. There is considerable opposition to the project, and the taxpayers are slow in making terms for the railroad to go through their property.

A dispatch from Wilmington, Del., dated April 13, says that the Baltimore & Ohio Railroad, through its engineer in charge of the main line, has applied to the president of the Wilmington and Brandywine Cemetery Company, in this city, for permission to run a tunnel underneath the cemetery. If the line should pass through the western part of the city a tunnel of nearly a mile in length will probably be necessary. Permission to construct the tunnel will doubtless be granted.

The Narrow-gauge R.R., called the B., M. & Q R.R. (and which has been under construction for two years back), has been merged into the old Peoria & Farmington Railway Co., and will be completed as a standard-gauge road, from Peoria west to Monmouth, during 1881. The engineer's department is as follows: John F. Wallace, Chief Engineer, with John Herron and David M. Grier as Assistant Engineers; headquarters, Farmington, Ill; John D. Lynch, Earthwork Contractor; Noble & Summers, Bridge Contractors.

Bark James A. Wright sailed April 8 for San Diego, with a general cargo of railroad material, valued at $77,000, for the California Southern R. R. Co.

Ship Highland Light sailed March 21, for Guaymas, Mexico, with a similar cargo valued at $125,000, for the Sonora R'y Co.

A shipment for the Mexican Central R'y Co., valued at $50,000, was made March 31, by steamship British Empire, of Alexandre's line.

Another shipment, April 7, for same Co., valued at $6,000.

A dispatch from Wheeling, W. Va., says: "An Eastern syndicate proposes to build a railroad from this place to Charlestown, W. Va., a distance of 180 miles, as soon as a local company with which it can contract is organized. The road is to be known as the Wheeling, Parkersburg & Charlestown Railroad. Incorporators were selected to-day, and steps were taken to make a survey immediately. All that is asked of the local organization is the right of way. The road will be standard gauge and will connect at Charlestown with the Chesapeake & Ohio road, and at this end of the line with the Pennsylvania system."

FORT WORTH, April 7.—The laying of the track of the Missouri, Kansas & Texas extension from Greenville to Mineola is going on at the rate of a mile a day. The link of fifty miles which is necessary to make the connection with the International & Great Northern Railway is to be completed by the first of May. The line from this place to Denison is to be used jointly with the Texas Pacific, and it is also to be completed so that the Missouri, Kansas & Texas will be running trains from St. Louis to Fort Worth by the first of May. The same company is rapidly extending the line southward from here through Waco and Belton to Galveston, and also from San Antonio to Laredo. Mr. Talmage, the General Manager of the system, is now in this State and says he has positive orders from Mr. Gould to complete both the Galveston and Laredo connections this year, and that he means to do it. He is building the roads in first-class style with steel rails, and the total length of the line when completed will be over 600 miles.

NEW PROJECTS.

The Brooklyn Rapid-Transit Commissioners on the 11th approved articles of association for the East River Bridge and Coney Island Steam-Transit Company. The capital stock is fixed at $1,000,000 in 10,000 shares of $100 par value.

A Montreal dispatch of the 8th says: "A railway company has been formed at Cornwall, under the title of the Eastern Ontario, New York & Boston Line. The object is to build a road from Carleton Place to Cornwall, with a view of bridging the St. Lawrence at the latter place and connecting with the railway system of New York and the New England States. The projected road would connect with the Pacific Road at Carleton Place."

The map of the Brooklyn Underground Railroad was filed in the Register's office in Brooklyn last Saturday. The route is laid out under Washington street, from the bridge terminus to Fulton street, under Fulton street from Washington street to Flatbush avenue, and under that avenue to the city line, near Walbone street, Flatbush, where it will connect with the Brooklyn, Flatbush & Coney Island road. A branch is laid out from Flatbush avenue, under Ninth avenue, close to Prospect Park, to Twenty-first street, where it will connect with the Prospect Park & Coney Island road. It is reported that the consent of the requisite two-thirds of the property-owners in Fulton street to the construction of the road has been secured. A large part of the stock of the company has been subscribed and $100,000 is already paid in.

ALBANY, April 11.—Articles of merger and consolidation of the Boston, Hoosac Tunnel & Western Railway Company with other railway companies in this State, to make a through line from the Hoosac Tunnel to Oswego and Buffalo, were filed in the Secretary of State's office to-day. The agreement includes the Boston, Hoosac Tunnel & Western, the Hoosac Tunnel & Saratoga, the Utica & Syracuse Air-line, the Syracuse, Chenango & New York, the Syracuse, Phœnix & Oswego, and the Mohawk & Lake Erie Railroad companies. The road will be 400 miles long. The capital stock is to be $25,000,000, divided into 250,000 shares. The capital stock of each of the companies consolidated is to be converted into the capital stock of the new corporations, one share of the new stock to be issued for each share of the present stock of the Boston, Hoosac Tunnel & Western, and one share of the stock for each $1,000 of the par or face value of the present stock of the other roads. The following is the Board of Directors of the consolidated road: Wm. L. Burt, Boston; Estes Howe, Boston; William Foster, Jr., New York; E. C. Benedict, New York; Wm. R. Garrison, New York; Chas. G. Francklyn, New York; Daniel B. Hatch, New York; E. B. Phillips, Boston; George O. Post, Fair Haven, N. Y.; Enos Wilder, New York; W. U. Burt, Boston; Josiah Case, Vernon, N. Y.; Myron P. Bush, Buffalo. The first officers are to be: President, William Burt; Treasurer, Estes Howe; Secretary, Wm. V. Reynolds.

CONTRACTING, MISCELLANEOUS, ETC.

Laborers are wanted upon the railroads now being built in Colorado. The Denver & Rio Grande company alone requires from 5,000 to 10,000 laborers for grading the 500 miles of extensions which it has under contract in Colorado and the adjoining territories. The offer is made of $2 a day to able-bodied men who apply at either Denver or South Pueblo. New extensions are projected which, on the completion of those now under way, will give employment to a large force.

DENVER, Col., April 12.—The *Republican* publishes a statement, said to have come from Denver & Rio Grande Railroad officials, to the effect that that company intends to import 10,000 Frenchmen and a corps of French engineers at an early day to work on the Denver & Rio Grande extension. It says that Count de Langrand, who has been in charge of the Mexican National Survey and Construction, will go to France to organize a corps of engineers and educate them in American railroad work and manner of operation. When this work is finished the corps will be dispatched to different parts of the country, each to secure a squad of laborers and instruct them as to future work. When 10,000 are secured, the squads will concentrate in Paris and be transported to New York and overland without delay. It is believed that a majority of them will be distributed equally on the Mexican and Salt Lake Divisions.

The contracts for building the new trunk line, New York, Chicago & St. Louis Railroad, have been let. J. S. & D. T. Casement will build all but the iron bridges between Cleveland and Buffalo, R. G. Haston & Co. from Cleveland to Tiffin, Ohio, eighty miles, the rails to be down by Jan. 1, 1882; McClain and others, of Chicago, from Fort Wayne to Chicago. Eight hundred thousand ties are bought along the line to Tiffin, fifteen hundred thousand more are to come from the Northwest and twenty thousand tons of steel rails are contracted in Cleveland, with the same quantity in Chicago. Thirty locomotives and one thousand coustruction cars are to be bought for delivery June 1. Every promise is given that the work will be rushed to completion between Buffalo and Chicago within this year.